1-19-2006

BROAD AGENCY ANNOUNCEMENT

U.S. ARMY RESEARCH INSTITUTE FOR BEHAVIORAL AND SOCIAL SCIENCES'S BASIC RESEARCH PROGRAM.

I. The Research and Advanced Concepts Office (RACO) of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) solicits new proposals for its fiscal year 2007 contract program of fundamental research in behavioral science. This Broad Agency Announcement is issued per FAR 35.016.

The purpose of the research is to add fundamental knowledge to behavioral science sub-disciplines and discover general principles. Novel and state-of-the-art approaches to difficult problems are especially welcome, as are integrated programmatic efforts to develop and test theory. A portion of available funding may be made available for meritorious proposals from minority institutions and historically Black colleges and universities, and these entities are encouraged to participate.

Investigations that focus on purely physiological mechanisms or psychopathology cannot be considered by this agency. However, neuro and network science approaches to social phenomena, memory, cognition, and personality are encouraged. Similarly, no consideration can be given to purely applied research projects (e.g., human factors studies or applied training programs). However, support for basic science does depend on the judgment that its research findings will stimulate new, applied behavioral technologies with potential for improving the effectiveness of Army personnel and their units.

The decision to fund a new basic research program consists of two stages. In the first stage, each proposal is peer reviewed for responsiveness and technical merit by at least two behavioral scientists. Those proposals that are judged responsive and receive high technical ratings go to the second stage. In stage two, ARI research unit chiefs are asked whether the research generated by a given proposal, if successful, would transition to their applied research programs. Proposals that are highly rated and identified as having transition potential to one or more ARI applied research programs will be given priority for funding. Proposals that are responsive and receive high technical ratings may also be funded but will generally be given a lower priority.

II. Scientific Problems for Basic Research.
To meet the transformation objectives of the U.S. Army over the next two decades, the Army must improve its ability to:

(1) Select, classify, train, and/or develop Soldiers and leaders who
   a. Are adaptable in novel missions and operational environments
   b. Can function effectively in digital, information rich, and semi-autonomous environments
   c. Can effectively collaborate in quickly formed groups and when distributed in high stress environments

d. Possess interpersonal and intercultural skills/attributes relevant to joint-service and multi-national operations.

(2) Accelerate development of leadership, interpersonal and emotional skills that traditionally develop over time and through direct experience.

(3) Support network-centric operations by enabling effective leadership and unit performance via advanced training and leader development methods.

In keeping with this broad perspective, the areas listed below are of special interest. It is particularly important that the research proposal clearly describe how its potential results might lead to applied research that would be meaningful to the Army.

III. BAA Basic Research Areas of Interest

A. Network Science – focus on cognitive and social domains

The Army operates within a complex natural, physical and social network. In particular, the Army is developing an increasingly sophisticated suite of networked technologies for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR). While much research is focused on the physical properties of these networked systems, this basic research program will focus on the cognitive and social domains – understanding individual, unit, and organizational behavior within the context of complex networked environments.

1. Individual.
   - Investigate cognitive pattern recognition (e.g., sensemaking). The focus of this topic is not on visual pattern recognition, but on the process by which the individual analyzes, organizes, and visualizes large heterogeneous information resources and experiences into conceptual patterns, ideas, and hypotheses.
   - Understanding relationships among neural activity and measures of cognitive ability, such as fluid intelligence, cognitive pattern recognition, adaptivity, mental imagery, and situation awareness is desired. While studies using MRI, fMRI, PET scan MEG technologies have begun to explore relationships between neural activity and psychological measures, these technologies may objectively document these relationships and refine associated measures and theory.
   - Understand the effects of a technologically rich, networked digital environment on a leader's ability to adapt quickly, make decisions, build teams, convey intent, and resist stress.
   - Understand the individual attributes that contribute to effective operation and tactical management of unmanned systems.
2. Unit (teams).
   - Understand the cognitive and social processes that lead to effective collective skill development and team performance.
   - Identify the principles for developing shared mental models that influence understanding of the leader's intent and team performance.
   - Determine the cognitive and social factors that facilitate or impair team formation and contribute to a sense of trust, especially for teams that are distributed and/or rapidly formed.

3. Organizational. Examine organizational concepts within the context of networked environments. For example, how does information and situational awareness change organizational behavior? -- hierarchical vs. flatter organizations, more autonomy vs. increased micromanagement, self-synchronization vs. increased chaos. Should information be constrained by organizational level to optimize performance?

B. **Training and Learning.**

1. **Intelligent agents + simulations**. The Army is increasingly developing interactive simulations for training. However, there are some key aspects to maximize the effectiveness of these simulation environments which need focused research efforts.

   - Automated performance evaluation of the learner is needed to modify simulation events, provide tailored feedback, and diagnostic after action reviews (AARs). In particular, we are interested in approaches that evaluate qualitative aspects of performance (e.g., tactics, negotiation, leadership) rather than the easier to collect quantitative data (e.g., kill ratio). Preference will be given to approaches that have reusable components (e.g., intelligent tutoring system shells) rather than handcrafted solutions for specific simulations or narrowly defined task domains.

   - Dialog capability for virtual coaches and synthetic characters. This research effort seeks novel approaches that make significant advances towards the goal of NL systems that understand the meaning of unconstrained NL input, perform active reasoning, and generate an appropriate natural language response. There is also the need for discourse management techniques to enable mixed initiative dialog, such as negotiation and interrogation. To increase extensibility to new domain, approaches that offer some capability to author (e.g., create, edit) aspects of the dialog system (e.g., lexicon, reasoning rules) are encouraged. Preference will be given to approaches that use modular components that can possibly interface with a variety of avatar technologies. Initial research activities should focus on English, but be built on technical approaches that could be extended to other languages.

2. **Complex tasks in technological environments**. Examine the human dimensions for optimizing training and performance for complex tasks. Investigations might address:
   - the types of training, optimum mix and sequence of methods (e.g., classroom, live exercises, simulations) and feedback required for sustainable improvements in complex task performance
   - methods to enhance transfer of training for complex tasks
   - methods to improve and accelerate an individual's capability to learn complex tasks
   - model the growth of expertise for complex tasks
   - the effect of multi-task training on reducing information overload and the extent that it can be measured and predicted

3. **Effective training methods**.
   - Feedback. Understand and model the role of feedback and feedback systems in the acquisition, retention, and transfer of individual and collective training.

- Self-regulated. Compliance and/or effectiveness in self-regulated training environments and understanding and modeling the effectiveness of "just in time" training.
- Compressed. Methods for compressing training time that maximize retention and transfer of training.
- Collaboration. Methods for mentoring and collaborative learning in web-based or distributed learning where team/group members are not familiar with each other and/or group team members may change unexpectedly.
- Interpersonal and social skills. Developing interpersonal skills such as communication, negotiation, mediation, and emotional intelligence.

C. Leadership

1. **Leadership skills**
   - Adaptability. Develop methods for assessing and developing/training flexibility and adaptability when faced with novel situations.
   - Interpersonal. Determine the interpersonal skills that are essential for Future Force leaders, how to differentiate these skills from traditional constructs, and what assessment devices can be used or developed to measure them.
   - Mentoring/coaching. Determine effective mentoring/coaching skills, and effective methods for developing these skills in leaders.

2. **Leading in complex environments**
   - Technological. Assess the nature of changes, if any, in the leader's role with the introduction of semi-autonomous, robotic, information, and communication systems. What characteristics will a leader need to possess in order to lead a mixed (human and machine) team, and how will they be measured?
   - Multi-cultural. Investigate methods to develop skills for leading multi-national teams and operating in multi-cultural environments.
   - Dispersed teams. Identify what aspects of leadership, if any, will be affected by the existence of dispersed teams addressing such questions as: What are the leadership skills necessary to effectively lead teams and organizations partially or fully dispersed geographically and/or temporally? What are the mechanisms that communicate and sustain a common understanding of command intent across geographic and temporal boundaries in dispersed teams and organizations?
   - Multi-team systems. Identifying what leadership skills are necessary to effectively lead and develop multi-team systems. What skills are necessary to effectively participate in multiple teams and roles within a multi-team system? How can overall effectiveness of a multi-team system be optimized? What role does task interdependence play within a multi-team system?
   - Shared intent. Understand and measure shared intent within vertical, hierarchical team structures.

3. **Objective measures**. Identify and validate *objective* measures of leadership performance. All current research in these areas identifies varying levels of leadership performance via secondary data, either through subjective scales or by assuming that

more effective unit performance is, by definition, the product of more effective leadership. Primary data for objectively measurable leadership behavior needs to be identified. With such data, applied research will have a solid basis for studying causal trait and training leading to leadership behavior. Also of interest is to determine the specific objectively assessed leader behaviors that influence team member's perceptions of leader performance and lead to enhanced unit performance.

4. **Leader development**
   - Accelerating leader development. Investigate methods for accelerating leader development to include assessment and training methods, tools, and devices.
   - Self-development. Identify the types of learning or knowledge that are best handled through self-development. Determine the most effective approach(es) for self-development (e.g., reflection, web-based training, self-awareness toolkits) for specific leader skills. For example, is it possible and practical for leaders to self-develop interpersonal skills through distance learning?
   - Maturity. Developing a better understanding of the relationship between adult learning and growth in leadership ability. Most adult learning research that has focused on young college students who are, at best, immature adults. Additional research is needed to explore the applicability of these principles to mature adults in their 30s and 40s.

D. Human Resource Practices

1. **Measurement and selection**, including:
   - Developing maximal performance measures to assess constructs such as persistence and dependability that have been traditionally measured using self-report;
   - Identifying the aptitude and skill requirements that are specific to the Future Force Soldier, with emphasis on the semi-autonomous/robotic/information/ communication requirements of the Future Force;
   - Assessing how persistence and dependability develop and contribute to effective performance and job tenure, how they relate to job factors, and how individual differences in such processes can be measured;
   - The extent to which practical intelligence is a function of an aptitude that cuts across domains and how to develop a method for measuring this aptitude;
   - How to anticipate change and develop performance measures for Future Force Soldiers for tasks that are not currently known.
   - Developing techniques to assess and validate variations in traits typically considered stable (e.g., cognitive ability) against relevant criteria

2. Identifying and modeling the development and relationships among the psychological, demographic and motivational factors that influence:
   - Recruit enlistment;
   - Soldier retention;
   - Soldier productivity and citizenship.

   This research may consider the nature of mediators such as values and ethics, personal motivation, job satisfaction, and organizational commitment in this process.

E. Social Systems

1. Social structures. The Army does not exist in a vacuum. It is a component of the overall societal system and is affected by changes in that system. We wish to support research leading to a better understanding of the military environment, including how major societal conditions and trends, changing Army missions, and Army culture influence recruitment, personnel retention, morale, cohesion, discipline, and military performance. We need to know how to achieve organizational change without severe adverse personnel effects. This research should result in models that consider the role of personal involvement by members at all organizational levels in successfully implementing change. We are especially interested in understanding individual differences in cultural awareness and how such awareness develops.

2. Origins and development of social systems and networks**.** The objective of this research is to understand how cooperative and altruistic behavior occurs against a backdrop of self-interest to produce effective working groups. Furthermore, we need to understand how group and individual social-psychological processes operate to manage and use information. We need to understand how social networks form and evolve in groups of various sizes. Results from this research area would help groups and leaders adapt their organizations to fit the operational environment and to minimize the effects of attrition in their social networks. Furthermore, would permit the disruption of the social networks of opposing forces.

F. Role of Affect (Emotions) in Calibrating Behavioral Action and Cognition.

The objective of this research is to understand the adaptive value of human emotions in calibrating psychological systems. This is the essence of self-control and self-awareness, both of which are critical to the success of any military operation. Psychological science does not understand well how emotions, as positive and negative evaluative processes, operate together or in opposition to influence actions and cognitions. We need better measures of these affective processes that include functional neuroimaging, changes in brain chemistry, as well as more traditional psychological measures. Understanding how emotions can help people to calibrate their behaviors and thoughts to achieve internal stability in difficult situations is critical to achieving effective performance on the battlefield and in other difficult military operations. We are especially interested in how leaders identify, shape, and channel their own emotions and the emotions of their subordinates to impact individual-level and group-level performance. We are also interested in understanding how people respond emotionally to information from human vs. robotic systems and how this affects the trust they place in those information sources.

IV. Time, Personnel, and Other Features of the Research.

Traditional Proposals. Typically, ARI basic research contracts have ranged between one and four years, with a median of three years. The median three-year basic research total contract cost has been $490,000 in recent years. Proposals may be for a complete research effort or formulated as one or more options that will be exercised by ARI if early results are promising. Short-term, small-scale efforts in high-risk/high-gain areas are welcome. Investigators are

encouraged to conduct their basic research in realistic contexts, where appropriate. However, the use of military participants is not encouraged. Both single-investigator and collaborative research efforts are acceptable, as are multidisciplinary approaches to a central problem. Collaborative efforts may involve researchers at a single institution or in cooperating institutions.

Offerors with questions about the suitability of their planned research may send e-mail or telephone (less preferred method) the relevant in-house research unit chief(s). However, use of e-mail is optional and is not a secure method of communication, and the government is not responsible for technical difficulties or disclosures resulting from e-mail communications. For help in locating the appropriate research unit chief(s), email the BRO program managers at BRO@ari.army.mil.

Early Career Proposals. As part of the Army Research Institute's continuing effort to support innovative and creative research, proposals are requested from individuals who have never received ARI funding as a Principle Investigator and are early in their research careers. All typical ARI evaluation dimensions will be used for *Early Career Proposals*, except the dimension that addresses the experience of the principal investigator. For this dimension, qualifications, capabilities, institutional resources and facilities will be considered, but not the experience of the proposed principal investigator. In all other respects, the materials in this BAA apply equally to both *Traditional* and *Early Career* proposals.

To be considered for the *Early Career* category:

1. Investigators must specify in the Proposal Abstract that they are requesting consideration under this funding category.
2. Projects should be designed for one year of funding, with the possibility of optional research (one to two additional years) should the initial work prove promising.
3. The research must fit into one of the stated BAA Basic Research areas of interest.
4. Investigators should be early in their research careers, i.e. less than five years post-doctorate, and cannot have previously received funding from ARI as a Principle Investigator.
5. While there is no specific amount of funding set aside for these proposals, initial budgets should be modest: approximately $100K for the initial year.

V. Application Procedures.

Proposals are to be e-mailed to **BRO@ari.army.mil** in electronic MS Word format. If proposals are funded, two signed hardcopies will be supplied at ARI's request. If the electronic version includes a signature from the appropriate representative of the university or company, hard copies will not be needed. The MS Word file document must include the complete technical and financial sections of the proposal.

All *Traditional* and *Early Career Proposals* must include:

1. An Abstract, Background, Technical Approach, References, Resumes of proposed researchers, and Budget, as described below.

2. Contact information such as e-mail addresses and telephone numbers to allow technical and contracting questions to be addressed;
3. Institutional endorsement, signature of the proposed principal investigator, time frames for all phases of the project, and detailed accounts of proposed work and budget.

The Abstract, Background, and Technical Approach sections of the proposals should be no greater than 25 pages in length. All pages should be single-spaced, have one-inch margins, and utilize a typeface no smaller than Times New Roman 12 font. Proposals should be very well-written, and author intention should be clear to technical reviewers who while having expertise in behavioral sciences, may lack concentrated knowledge in the proposed domain. Proposals should be sufficiently detailed to be responsive to the criteria, described below, for evaluation. Additional materials may include vitae, references, and institutional information.

Scientific peers will review the proposals according to the following dimensions in order of importance:

1. Importance of the research to ARI's mission and Army concerns.
2. Technical merit, appropriateness, and feasibility of the proposed approach.
3. Scientific significance of the issue and originality.
4. The qualifications, capabilities, and experience of the proposed principal investigator and key personnel, and institutional resources and facilities. This final dimension will be altered for those *Early Career* proposals, as described above and under **Section IV**, *Early Career* paragraph.

Each dimension will be given a letter grade between A and F. Those proposals with very low importance to ARI and the Army will be unable to recover even with high grades on other dimensions. Technical merit is significantly more important than dimensions 3 or 4 (except for dimension 4 in the case of early career proposals). Scientific significance is somewhat more important than qualifications. Successful proposals must propose costs that are both affordable and realistic for the proposed effort. The evaluation of proposed cost is subordinate to the technical evaluation. Past performance, prior research, and research and development contracts to include timely completion and cost effectiveness will be considered.

The following material applies to both the *Traditional* and the *Early Career* proposal categories. All research proposals should contain the following sections: Abstract, Background, Technical Approach, References, Resumes of proposed researchers, and Budget.

Abstract. The abstract should be one page or less. It should describe the problem underlying the research, the hypothesis being tested, explain the objective of the proposal, and provide a condensed, but meaningful description of the technical approach. It is very important that in the abstract and in the body of the proposal, the author makes quite clear how this basic research, if successful, could lead to applied research in areas dealt with by ARI. Authors should reference the most relevant sections of the BAA in the abstract.

Background. The background should include a description of the problem, as the proposal author understands it. It is helpful if the author shows an understanding of the Army and ARI contexts

that apply to the proposed research. The description of the problem should be tied to an account of significant research that is applicable. Clearly, there will not be enough space to write a critical, annotated bibliography, but the author should demonstrate meaningful knowledge of the background of the research that is being proposed.

Technical Approach. This is a critical part of the proposal and it should be responsive to the listed criteria. It should include a description of the hypothesis upon which the research is to be based, the goal of that research, and a detailed account of how the research is to be done. This account should be much like the methods section of a research paper. It should include a description of the data to be collected, the methods for collecting the data, the number and source of subjects and how they will be acquired, and the proposed research design and likely analysis methods. It is possible that an intermediate or final product of research will include training packages, simulation models, or other software-based devices. In this case, the author should show how the product relates to the hypothesis being tested and should provide sufficient detail to permit understanding and evaluation. The technical approach should include a statement that details the major tasks to be performed and products to be produced. In the case of a one-year proposal, the statement should be divided by quarters of the year. In the case of multi-year proposals, it should be divided by year. The combined length of the *Background* and *Technical Approach* sections should be no longer than 24 pages.

Reference List. This should be a list of all the references called out in the body of the proposal. It should not include publications that are not referred to in the body. The references list must be in American Psychological Association format, APA 5th Edition.

Résumés. Résumés or vitae should be included for all proposed researchers with special emphasis on the Principal Investigator(s). It is particularly important that resumes include publications that bear on the research being proposed.

Budget. This should be a typical budget section as is required by other federal agencies. However, it should also include a description of total dollars required overall, per government fiscal year (the government fiscal years run from October 1 through the following September 30), and the number of person hours/months per government fiscal year broken out by personnel type (senior scientist, graduate student, research associate, clerk, etc.).
Proposers who are not in the Washington, DC area should budget at least one trip per year to ARI in Arlington, VA to present the progress of their research. Proposers who are in the Washington, DC area should budget this trip to Kansas City, Missouri.

VI. *Concept Papers*. While *Concept Papers* are optional, ARI invites potential offerors who would like an early indication of the suitability of their topics to submit *Concept Papers* by e-mail (preferred) to BRO@ari.army.mil or by post to the below address**.** If submitted, Concept Papers must be in the form of an MS Word Document, be five single-spaced pages or less, concisely address the proposed research, and should contain only an approximate total budget projection. Please enclose an e-mail address and a telephone number where you can be reached. Please submit concept papers **at least 6 weeks before** the deadline for proposals. Concept papers submitted later than this date may not receive a timely response.

VII. Deadlines. To be considered for funding, electronic versions of the formal proposals (in for form of a single MS Word Doc file) must be received at ARI by e-mail no later than **3:30 P.M. EST 1 May 2006.** Electronic versions of the technical and cost proposals must be combined into one MS Word Document file. This file must be e-mailed to BRO@ari.army.mil. Following the evaluation process, authors of those proposals that have been selected for award will be informed. At that time, a signed original and one copy of the complete proposal (technical and cost) should be FEDEXed to ARI at the postal address.

Awards will be made between October 1, 2006 and September 30, 2007.

VIII. Inquiries. Correspondence, inquiries, and concept papers may be sent to BRO@ari.army.mil or by mail to the postal address below.

IX. Postal Address.

U.S. Army Research Institute
Research and Advanced Concepts Office
ATTN: Program Analyst
2511 Jefferson Davis Highway
Arlington, VA 22202-3926